5.1 POTABLE WATER SYSTEM DESIGN

5.1.1 General Information

A. This document provides guidance and minimum design criteria for the modification and construction of water systems within the City of Goodyear. It is intended for use in the planning, design, and plan preparation processes.

B. Ordinance Requirements

1. The developer shall install, at his/her expense, all on-site and off-site improvements necessary to service the development. This may include pump stations, reservoirs, transmission mains, pressure reducing valves, and other facilities necessary to service the development. This includes payment of all required development fees.

2. Each lot in a subdivision shall be supplied with safe, reliable, and potable water in a sufficient volume and pressure for domestic use and fire protection. This shall be verified by the engineer by performing a flow test of that part of the potable system to be extended, unless previously verified under Preliminary Plat. The flows and pressure must meet minimum requirements for domestic and fire flow requirements. This shall be verified on the cover sheet by the engineer.

3. If the occupancy is to be supplied with domestic service and with fire flows from a storage tank or facility, the engineer must provide a report indicating that sufficient volumes exist as required by the Goodyear Fire Department, and are available to meet calculated fire demands as defined by the engineer.

4. Upon development of property for which City water service is desired and available, the developer shall submit a plan for the water system prepared by a professional engineer licensed in the State of Arizona.

5. The City requires water mains to be installed along the entire length of the property line frontage of the property to be developed, where future extension of the line is possible. The property line frontage is that portion of the property along a public right of way and/or public utility easement. If a parcel to be developed has more than one property line frontage, the City shall also require improvements to be installed along the entire frontage(s).

6. For current information on ordinance requirements, review of the Goodyear Revised Code is recommended.

7. City Policies
Proposed developments determined by the City to have a strong impact on the water system shall be analyzed on the City's computer model at the developer's expense. The effects of peak and fire flows from these developments will be examined to ensure proper sizing and layout of proposed water system elements and to assist the City in planning its own water system facilities to meet the demands imposed by large-scale developments.

C. Private Water Companies

1. Portions of Goodyear's municipal service area are provided water service by private water companies. Private companies are those defined by Arizona Revised Statues.

2. Modifications or construction of water systems within private water company franchise areas shall be reviewed by the City and the subject company. Goodyear shall review private water systems to City of Goodyear current standards. The applicable review fees shall be paid and a note placed on the drawings delineating operation and maintenance responsibilities. The City cannot provide water service within private water company franchise areas.

D. Design Reports

1. A design report or memorandum shall be required. The design report shall present necessary information concerning design assumptions and computations, demands, pressure and flows, cathodic protection requirements, and rights-of-way or easements that are being provided.

Design report shall address the location of storage facilities serving the site, the adequacy of available storage and the ability to meet fire and domestic flow requirements. Report shall show connection(s) to the existing system supply (size, location, length, etc.) and address whether the failure of any single pipe will disconnect the site from the system.

2. The objective of the report is to provide sufficient information to adequately review the project.

E. Master Plans

1. When required by the City, a Master Water Plan and Report shall be prepared in accordance with the City's Design Standards and Policies by a professional engineer registered in and licensed to practice in the State of Arizona. The Master Plan report shall address, but not be limited to, the following:

   a. The Master Plan will become the basis for a Water and Wastewater Service Agreement between the developer and the City of Goodyear when such agreement is required by the City. The agreement will specify terms and requirements for water and wastewater service to the development. The introduction to the report should state this.

   b. All development projects shall be responsible for determining their specific water system needs. Service for proposed developments shall not be produced at the expense of existing customers and the Water Master Plan shall verify this.

   c. A computer water network model, using the Kentucky Pipe Program for the Analysis of Pressure and Flow in Pipe Distribution Systems, or a similar program approved by the City Engineer, shall verify that adequate pressures and flows will be available within the development. The model shall be provided to the City electronically for purposes of updating the City Water Distribution Model. In addition, if certified flow tests performed on the system to which the project is to be connected do not show that sufficient capacity exists, the computer model shall be used to determine the required on-site and off-site facilities such as pump stations and pipelines necessary to serve the project. If the proposed development requires a change in zoning which increases density or proposes a water system different from the City's current Water Master Policy, then additional off-site calculations will be required.

All model data shall include the following:

(1) Demands shall be calculated according to densities shown in Table 5-1, Average Day Water Demand Per Dwelling Unit.

(2) The system shall provide maximum day demands (2.0 times average day demand) plus fire flow. The fire flow used in all calculations should be a minimum of 1,000 gpm for residential under 3,600 square feet and a minimum of 1,500 gpm for multi-family and commercial per the Uniform Fire Code as adopted by the City.

(3) Verification of the ability to provide peak hour demands (4 times average day demand) shall be provided.

(4) The minimum required pressure throughout the water distribution system is 40 psi at the highest finished floor elevation. A residual pressure of 20 psi is allowed under fire flow conditions.

(5) Pipeline calculations shall verify that head loss per one thousand (1,000) feet of any pipe shall be no more than ten (10) ft/ft during peak period demand conditions and not more than eight (8) ft/ft under any maximum day conditions.

(6) Sufficient supply for demand must be provided without the use of dedicated fire pumps or backup pumps. Calculations which include both domestic demand plus fire flow may use fire pumps as a portion of the supply.

(7) A computer disk containing all calculations shall be submitted along with the Master Plan report.

d. Each Master Plan must show the following:

(1) All proposed on-site and off-site facilities including, but not limited to, pump stations, transmission and distribution mains, and reservoirs.

(2) Proposed street locations, parcel boundaries, and proposed lots within each parcel.

(3) Contour lines at two (2) foot intervals showing the elevation of the land surface. Sufficient information must be provided to evaluate network node elevations.

(4) All pressure zone boundaries.

(5) A separate area location map shall be provided showing existing and proposed streets, as well as existing parcels surrounding the project to a distance of one (1) mile from the exterior boundaries of the project. Assessor's maps can provide the information required to prepare these composite maps.

(6) The scale of all maps must be sufficient to show all required information clearly.

2. All water lines which cross golf courses or other open areas shall do so within established roads. If dedicated roads are not practical, then crossing must be within an easement twenty (20) foot wide, or at the discretion of the Public Works Director, or his designee. All other water lines outside dedicated rights-of-way shall be on easements not less than twenty (20) feet wide, or at the discretion of the Public Works Director, or his designee. No walls shall cross these easements.

3. The Water Master Plan must show compliance with the Goodyear Revised Code to construct pipelines, if not already in place, across all dedicated frontages of the development.

4. A construction schedule shall be included in table format for all water related construction required to serve the development, per signed zoning or other agreements.

5. Compliance with the City's current Water Master Policy encompassing the respective area.

6. More specific information regarding master water plan requirements and the City's current Water Master Policy can be obtained by contacting the Public Works Department at 932-1637.

F. Production Systems

1. Wells

a. The City shall be notified of any proposed well drilling and review plans of all proposed ground water wells.

b. Under the Arizona Groundwater Management Code, the Arizona Department of Water Resources (ADWR) regulates all groundwater wells in Arizona. Before drilling and installing a well, a "Notice of Intent to Drill" and "Application for a Drilling Permit" must be obtained from and filed with ADWR. The well must subsequently be registered with ADWR. Forms and additional information are available from ADWR Operation's Division, phone 542-1581.

2. Reservoirs

a. Storage facilities must provide emergency fire protection and maximize the use of water production facilities. Therefore, storage in each pressure zone shall exceed each of the following criteria:

(1) Three hours fire flow reserve + 25% of maximum day demand, or;

(2) One average day demand

3. Booster Pump Stations

a. Booster pumps shall be designed and required to maintain adequate pressure for domestic and fire protection water supply. City of Goodyear pump system criteria and details available at the Water Operations Division. (All stations shall provide chlorine facilities and telemetry compatible with the Water Operations Division current system.)

b. Designers shall refer to Engineering Bulletin No. 10 by the Arizona Department of Environmental Quality for additional design criteria. The City shall receive dedicated land for booster stations.

c. A preliminary or basis of design report shall be prepared and submitted to the City for acceptance prior

to final design. This report shall outline the type of equipment and controls proposed for the station. A final design report prepared by a registered professional engineer licensed in Arizona must accompany all pump station design drawings.

4. Pressure Reducing Valves

   a. Pressure reducing valves (PRVs) shall be required to maintain reasonable pressures within the distribution system.

   b. In general, distribution systems should not be designed to operate at pressures in excess of one hundred-twenty (120) pounds per square inch (psi). PRVs shall be designed in accordance with the criteria delineated in MAG Supplemental Detail No. 2342.

   c. It is important to note that the Uniform Plumbing Code requires a pressure regulator when local water pressure exceeds 80 psi.

   d. The City of Goodyear operates its system from wells and pump stations that commonly have pressures exceeding 80 psi. Changes in demand, supply, and the distribution system also vary the pressure at single family residences. The City may require single family residences to have a PRV installed on service lines. A written variance request may be submitted to Water Operations for their review and concurrence or denial.

G. Water Main System

1. The City of Goodyear water main system is based on a grid system with three (3) basic classifications of water lines which are determined by use. These classifications are:

   a. Transmission - Located in arterials or collector streets water line size 16-inch and larger shall have no service connections.

   b. Distribution - Water line sizes 6” to 14” in size located in arterial, collector or residential streets. Distribution mains are feed by transmission lines and may have service connections.

c. Services - Water line from the distribution line to the meter, including the meter and all connections.

2. All development shall provide for water distribution and service lines of appropriate sizes, with normal locations as follows:

a. Transmission water lines

(1) When existing or future development requirements are such that in the opinion of the City staff a transmission water line is necessary. Then an appropriate sized transmission water line will be constructed by the developer.

b. Distribution water lines

(1) In arterial street alignments (mile alignments), 16 inch minimum diameter lines. In minor arterial street alignments (1/2 mile alignments) 12-inch minimum diameter lines.

(2) All other locations, 8 inch minimum diameter lines; except single family residential developments may be served with 6 inch diameter lines, provided all fire hydrants on the 6 inch lines are fed from two directions.

(3) These are minimum guidelines and the City may require larger sizes in unusual circumstances.

c. Service water lines.

(1) Metered taps for single-family residence shall be installed per Detail G-3310.

(2) For all other types of development, metered taps shall be located outside of street improvements but within the right-of-way or an easement.

(3) All services shall require backflow prevention based on the hazard rating.

d. Fire sprinkler line locations shall be such that maintenance activity will not disrupt normal access to the development. Backflow prevention is required per Detail G-3352 or G-3353. Fire Department Connection shall be painted red.

e. Multi-unit sites shall require isolation valves (post indicator type) to isolate each unit.

f. Post indicator valves shall be locked in the open position.

g. ADHS Bulletin 10 shall apply to all City of Goodyear water lines.

5.1.2 Technical Design Requirements

A. Water Lines

1. Materials and Details

a. Standard materials and details for pipe 12 in. diameter and smaller shall be per Maricopa Association of Governments, Uniform Standard Specifications and Details for Public Works construction. Materials and details for pipe larger than 12 inch diameter shall be ductile iron or city approved material.

b. Pavement replacement type and compaction type shall be indicated on each sheet.

c. Ductile iron pipe may be required in cases where pipelines could be subjected to heavy external loads. Most notably, these include, but are not limited to, deep pipelines and pipelines in the roadway alignment which would be exposed to heavy construction vehicle loads prior to paving.

d. Fireline connection off of service lines (four (4) inches and larger), and all hydrant connections shall be constructed of ductile iron pipe, minimum Class 150 or equal to or greater than the supply line class.

2. Location within Right-of-way

a. Right-of-way shall be dedicated prior to any construction.

b. Water line location in rights-of-way shall be in accordance with Standard Detail G-3132 and G-3136.

3. Easement Requirements

a. No water lines shall be installed in an easement unless the Public Works Director, or his designee, has approved in writing the placement of the line(s) in an easement(s) and the property owner has granted the necessary easement(s) and right(s)-of-way.

b. If approved, water lines outside of public rights-of-way shall be placed in easements not less than twenty (20) feet wide, or at the discretion of the Public Works Director, or his designee. The water lines shall be centered in the easement and shall be accessible from a public right-of-way.

c. Easements larger than twenty (20) feet in width may be required if other utilities are also located in the easement or if additional area is needed for maintenance equipment access due to the size and/or depth if the line(s).

d. Easements shall be free of obstructions, shall not be located in a fenced area, and shall at all times be accessible to City service equipment such as trucks, backhoes, etc. Areas in question shall be approved in writing by the Public Works Director, or his designee.

e. Easements shall be dedicated prior to any construction.

4. Depth

a. Minimum cover from finish grade to the top of the pipe shall be:

(1) 48 inches for water lines 12 inches and larger

(2) 48 inches for water mains in industrial areas or in major collector and arterial streets

(3) 36 inches for water lines smaller than 12 inches, and all lines in secondary streets, interior streets, and other locations.

b. The proposed depth shall be clearly noted in each plan sheet. Any changes in depth required to avoid conflicting utilities, etc., shall be noted.

B. Valves

1. Materials and Details

a. All gate valves shall be resilient seated, solid wedge gate, shall open left, and shall conform to the City of Goodyear Specifications for Resilient Seated Gate Valves available at the Public Works Department.

b. Butterfly valves shall not be permitted on mains less than 16 inch diameter. On larger pipe butterfly valves shall be required.

c. Blocking will be concrete only per MAG Std. Detail 340.

d. Per City of Goodyear standard detail #2305, valved by-pass lines are required on all valves sixteen (16) inches or larger in diameter. In important installations and for deep pipe cover, pipe entrance access manholes shall be provided so that the internal valve parts can be serviced.

2. Spacing

a. The maximum spacing of valves in industrial/commercial and multi-family districts shall be 500 feet. In single-family residential, the maximum spacing shall be 700 feet.

b. The desired maximum number of valves required to isolate an area is four (4). Two or three is preferred. One fire hydrant is the preferred number to be out of service, with two the maximum number. Twenty (20) homes shall be the maximum number to be without water per closure. Valves shall not be located within a driveway.

c. Approved valve spacing and location shall be strategically placed for operation and maintenance of the system, per Public Works Department.

d. Valving shall be provided to allow isolation of lines crossing major washes, railroads, major highways, bridges, and airports.

e. A valve shall also be provided on each hydrant branch.

f. Valved by-pass lines are required on all valves sixteen (16) inches or larger in diameter.

g. In important installations and for deep pipe cover, pipe entrance access manholes shall be provided so that the internal valve parts can be serviced.

h. All mains branching from feeder mains or loops shall be valved adjacent to the feeders so that the branch mains can be taken out of service without interrupting the supply to other locations.

i. Any water line that will be extended in the future shall have a valve, along with a 13 foot minimum stub with cap and 2 inch corp. stop, at the end.

j. For distribution lines 12 inch and smaller, one valve shall be placed on each side of major canals, railroads, etc.

k. One gate valve shall be placed between each fire hydrant and the water main.

3. Operation

a. All water valves that control the City's energized water lines shall only be operated by City personnel.

b. City personnel will be responsible for opening and closing of all existing water valves where a contractor must tie into an existing water main stub that does not have a valve on the end.

c. Only City personnel shall turn the water valve that lies between the new system and the existing system for the purposes of chlorinating the water lines, flushing water lines and pressure testing water lines.

d. Only City personnel shall operate valves that control the Water System Zone Split. These valves are designated by red valve covers.

e. All closed valves shall be designated by painting valve covers white.

C. Fittings

a. Capped dead end lines shall be tapped with a flushing device as per MAG Standard Detail 390, Type "B", but not less than two (2) inches in diameter. Blow-off valves, fire hydrants, or other suitable means shall be installed at the end of dead-end mains to allow periodic flushing of the lines.

b. Flushing devices shall not be located in washes, detention/retention areas, sidewalks, or driveways.

2. Air release valves shall be installed at all changes in slope of water transmission mains twelve (12) inches or larger in diameter, as follows:

a. When water line changes from a positive slope to a zero slope in primary direction of flow.

b. When water line changes from a positive slope to a negative slope in primary direction of flow.

c. When water line changes from a zero slope to a negative slope in primary direction of flow.

d. When vertical alignment changes to undercross or overcross another facility (i.e. utility, drainage wash, etc.) air release valves (per the above guidelines) and isolation valves shall be installed on both sides of the crossing.

3. NOTE: Slopes less than or equal to 0.002 ft/ft shall be treated as zero slopes.

4. Install a hydrant/bypass assembly as required by the Public Works Director, or his designee.

5. All air release valves shall be a combination air/vacuum release type.

6. No water line shall be deflected either vertically or horizontally, in excess of the recommended by the manufacturer of the pipe or coupling without the appropriate use of bends or offsets. Fittings may be required where more than two pipe lengths are deflected.

7. Thrusts on pipelines with unrestrained joints occur wherever a bench or branch outlet exists. If the lengths of pipe are joined by tension joints, such as welded joints in concrete pipelines,

other forms of anchorage may not be required. The determination of whether or not a given section of pipeline needs restrained joints or other means of anchorage shall be made by a qualified professional engineer and approved by the City. All thrust anchorage's shall be designed for a safety factor of not less than 1.50 under maximum pressure loading.

8. All changes in direction in water lines six (6) inches or larger in diameter shall be marked with an electronic marker. Valve locations permit adequate identification of pipeline location (typically at crosses and tees). Electronic markers shall be a self-leveling type and operate on a frequency of 145.7 Khz up to a depth of four (4) feet.

D. Water Services

1. The developer shall install all 1 inch, 1-1/2 inch and 2 inch water services in new subdivisions.

2. The developer shall install all water meter boxes per City requirements.

3. The developer is responsible for application and payment of all applicable fees.

4. Water services installed outside of public right-of-way shall be contained within a dedicated easement.

5. Water meters will not be in concrete.

6. Water service lines and meters shall not be located in parking lots, driveways, sidewalks, washes, or retention/detention areas.

7. Branch water service line tees are not allowed.

8. Construction plans must indicate location of meter service lines and sewer taps to each unit referenced with stations and dimensions from the street center line or monument line. Location of sewer service relative to the water service shall also be shown.

9. No service connections shall be made to water lines sixteen (16) inches or larger in diameter, or to water lines designed solely to transmit water from one pressure zone to another pressure zone.

10. All galvanized iron and polyethylene water service lines in sizes three-quarter (3/4) inch through two (2) inches which are exposed during construction shall be replaced in their entirety with Type “K” copper tubing. This will include the replacement of iron service saddles with bronze saddles and the replacement of both the corporation stop and the meter stop in all cases.

11. If water meter services are located incorrectly by the developer and must be moved to avoid conflicts, the City will relocate them a maximum of 10 feet. If the desired relocation is greater than 10 feet, the old service must be shut off at the main. A new service shall be installed by the City after the developer has paid fees and both services shall be noted on the "as-built" plan.

12. Existing water meters shall be relocated by the City only after the developer pays the prevailing fees.

13. The size of the meter will correspond to the size of the tap, except the minimum tap size shall be 1-inch. Extra attention is recommended when sizing services for custom home lots where meter sizes often exceed one (1) inch.

14. All meters will not be fenced in or enclosed and must be accessible at all times.

E. Water Meters

1. The water meters shall be sized and designed in accordance with the requirements of the Uniform Plumbing Code as adopted by the City.

2. The water meters shall be installed in accordance with Detail G-3312 and the MAG Std. Specifications Section 631 shall be used as an acceptable guideline.

3. Water meters 3" and larger shall be installed in accordance with the MAG Std. Detail 345-1 and 345-2.

4. The water meter to be used shall Conform to the City of Goodyear Specifications for Water Meters, available at the Public Works Department, and shall satisfy the following requirements:

a. Oscillating Piston - Single and multi-family residential.

b. Compound - Generally residential, this unit is designed for use where most of the flow is low, some intermittent and no more than occasionally high.

c. Turbo - This shall be used where a wide variety of flows can be expected but most are at the high end.

d. Propeller - This shall be used where low flows never occur, the flows shall be consistent within a limited range.

F. Taps

1. A three foot minimum separation is required between service taps at the mainline.

2. Wet Taps - Tapping sleeves will not be installed on M.O.A. A.C.P.

a. The Contractor shall make all wet taps from the City's energized water system.

b. The developer is responsible for preparing application and payment of all applicable fees prior to taps being made.

3. Dry Taps

a. The developer shall make all dry taps for 1 inch, 1-1/2 inch, and 2 inch water service connections.

G. Cross-Connection Control Program

It shall be the responsibility of the City of Goodyear to protect the public water system from health hazards and non-health hazards by the implementation of a cross-connection control program. The program shall consist of inspection by the City of Goodyear Water Operations Division and implementation of a backflow prevention and maintenance program, as outlined in the "Manual of Cross-Connection Control" published by USC.

1. Inspection

a. Air-gap separation shall be required on premises where entry is restricted so that cross-connection inspections can not be made with sufficient frequency or at sufficiently short notice to assure the following high hazard conditions do not exist.

(1) Public water system is used to supplement reclaimed water.

(2) Wastewater is pumped and/or treated.

(3) Reclaimed water is used.

(4) Hazardous substances are handled or stored.

(5) Irrigation systems exist into which fertilizers, herbicides or pesticides could be injected.

(6) Unapproved water supply exists which is interconnected with public water system.

(7) Deemed necessary by ADEQ or City of Goodyear Water Operations Division.

b. Reduced pressure principle (RP) backflow prevention device shall be required on premises where entry is not restricted so that cross-connection inspection can be made with sufficient frequency or at sufficiently short notice, where the following high hazards may exist and an air-gap has not been deemed necessary by ADEQ or the City Water Operations Division.

(1) Service 2-1/2 inches and larger.

(2) Wastewater is pumped and/or treated.

(3) Reclaimed water is used.

(4) Hazardous substances are handled or stored.

(5) Unapproved water supply exists which is not interconnected with public water system.

(6) Potential for system modification.

(7) Repeated history of cross-connections being established or re-established.

c. Double Check Valve Assembly (DC) backflow prevention device shall be required on premises where entry is not restricted so that a cross-connection inspection may be conducted with sufficient frequency or at sufficiently short notice, where the following, but not limited to, non-health hazards may exist and an air gap or RP assembly has not been deemed necessary by ADEQ, or the Water Operations Division.

(1) Back siphonage or back pressure situation

(2) Non-Health hazardous materials are being stored or handled

d. Pressure Vacuum Breakers (PVB) or Spill-Resistant Vacuum Breakers (SVP) shall be required when entry is not restricted, so that a cross-connection inspection can be made with sufficient frequency, or at sufficiently short notice, where the following, but not limited to, non-health hazard , or health hazards may exist under a back siphonage condition, and an air gap, RP or DC has not been deemed necessary by ADEQ, or the Water Operations Division.

(1) Landscape irrigation that is only subject to back siphonage

(2) Internal protection (point source)

e. Double Check Detector Assembly (DCDA) shall be deemed necessary on all non-residential fire sprinkler systems where the City's potable water supply is used. A residential system shall be considered those systems found in residential dwellings consisting of approved potable water piping and materials. A DCDA shall be required on all Class I, II, III and IV fire protection systems.

f. Reduced Pressure Principle-Detector Assemblies (RPDA) shall be deemed necessary on all Class V and VI fire sprinkler systems. A RPDA shall also be deemed necessary when any hazardous of non-hazardous solutions are added to the fire sprinkler systems, or used as part of the fire protection system.

g. A list of approved backflow assemblies is available from the Water Operations Division of the Public Works Department. (932-1637)

2. Implementation
The consumer, at own expense, shall install, operate and maintain the approved backflow prevention device(s) as required by the City of Goodyear.

a. Installation of approved backflow prevention devices shall be as follows:

(1) An Air-Gap separation shall be located as close as practical to the users connection at the meter. The piping between the users connection at the meter. The piping between the users connection and the receiving tank shall be entirely visible unless approved in writing by the Water

Operations Division. The air-gap separation shall be at least twice the diameter of the supply pipe, measured vertically from the flood rim of the receiving vessel to the supply pipe. In no case shall this separation be less than one inch.

(2) A Reduced Pressure Principle backflow prevention device shall be installed as close as practical to the users meter. The device shall be installed a minimum of 12 inches above grade and not more than 36 inches above grade with 12 inch clearance on both sides, and in a manner where it is accessible for testing.

(3) A Double Check backflow prevention device shall be installed as close as practical to the users meter. The device shall be installed a minimum of 12 inches above grade and not more than 36 inches above grade with 12 inch clearance on both sides, and in a manner where it is accessible for testing.

(4) A Pressure Vacuum Breaker or Spill-Resistant Vacuum Breaker backflow prevention device shall be installed as close as practical to the point source or user meter. The device shall be installed a minimum of 12 inches above all downstream piping and use of valve(s). This distance shall be measured from the bottom of the assembly. Assembly shall be installed where it is accessible for testing.

(5) A Double Check Detector Assembly and Reduced Pressure Principle Detector Check Assembly backflow prevention device shall be installed as close as practical to the property line. The device shall be installed a minimum of 12 inches above grade and not more than 36 inches above grade, with a 12 inch clearance on both sides, and in a manner where it is accessible for testing.

b. Maintenance of backflow prevention devices shall be as follows:

(1) Maintenance of backflow prevention devices shall be tested immediately after installation,

relocation, or repair. Devices shall not be placed in service unless they are functioning as required. Devices shall be tested annually or more frequently if determined to be necessary. When devices are found to be defective they shall be repaired or replaced. Backflow prevention devices shall be tested by persons certified as a General Tester or specialist by USC or ASSET. Accurate records of these tests shall be maintained by the City for a minimum of five years. Copies of these records shall be submitted to City of Goodyear Water Operations Division.

H. Fire Department Connections (FDCs) shall be installed as follows:

1. FDCs shall be located and arranged so that hose can be readily attached without obstructions.

2. Height shall be a minimum of 18 inches to the bottom and a maximum of 48 inches to the top of the connections. See Detail G-3330.

3. FDCs shall face onto access, be unobstructed, and be installed on the customer side of the water supply check valve.

4. FDCs shall be painted red.

I. Pressure Requirements

Pressure extremes in water systems result in potential for contamination to enter the network. Low pressures in the water system may allow polluted fluids to be forced into the system. High pressures may cause ruptures or breaks in some elements of the network.

1. The normal working pressure in the distribution system should not exceed one hundred (100) psi.

2. Domestic systems shall be designed to maintain a minimum residual pressure of forty (40) psi at the highest ground level to be served under all flow conditions. (Minimum pressure for fire protection may differ. See Fire Flow Requirements in this section.)

3. All water mains and service lines shall be designed for a minimum normal internal working pressure of one hundred-fifty (150) psi plus appropriate allowances for water hammer.

4. Water hammer may produce momentary pressures greatly in excess of normal static pressures, thus increasing the probability of water main failure.

    a. Suitable provisions shall be made to protect the system from water hammer pressures.

    b. The occurrence and severity of water hammer can be reduced through the use of slow-closing valves, pressure-release valves, surge tanks, variable frequency drives, soft start motor controllers, and air chambers.

5. In cases where greater than the above noted maximum pressures are required for effective operation, all elements of the system shall be designed accordingly. Pressure information for existing water lines may be obtained by having a flow test performed on the existing system. These tests may be performed by a private fire protection company who must certify the results of the tests and submit them to the City for approval.

6. A Right-of-Way Permit issued by the Community Development (932-3494) is necessary to perform the test and the City shall be notified a minimum of forty-eight (48) hours before the test by contacting the Public Works Department.

J. Design Flows

1. Design flows for transmission mains shall be based on the current City Master Policy to provide for the water system's ultimate demands. Calculation of the flows for the specified development will be calculated to ensure that existing supply is sufficient to meet proposed development. All improvements necessary to meet proposed flows to include pumping stations, reservoirs, lines, and appurtenances are to be a part of the design.

2. Peak flow calculations on transmission mains shall be based on fireflow figures in accordance with the City of Goodyear Fire Code. See Table 5-1 for average day demand flows.

3. Design flows for all distribution systems shall be based upon existing flows and pressures as documented by the engineer.

The engineer must have a flow test performed by a private company who will certify the results in writing to the City. These flows will be used by the engineer for the design and design report for all water line projects Fire Protection Requirements.

K. System Layout

1. Water must be maintained in the City Rights-of-way. Hydrants, meters, blowoffs, and valves shall not be located in washes, detention/retention areas, driveways, or sidewalks.

2. All new water mains shall be designed in a looped configuration whenever feasible to provide maximum circulation.

3. Long, straight reaches of transmission mains shall be marked every 440 feet with an electronic marker. Installation of an electronic marker may be omitted when valve locations permit identification of pipeline location.

L. Pipe Cover and Separations

1. All mains twelve (12) inches or larger in diameter shall have a minimum cover of forty-eight (48) inches over the top of the pipe and shall be marked with locating tape. Water mains in industrial areas or in major collector and arterial streets shall have a minimum cover of forty-eight (48) inches over the top of the pipe. In other locations, mains smaller than twelve (12) inches in diameter shall have a minimum cover of thirty-six (36) inches over the top of the pipe.

2. Cover for water mains shall be measured from existing or proposed finished grade of pavement or natural ground, whichever measurement is greater and results in adequate pipe protection during construction.

3. Caution should be taken in design and construction to protect all water supplies from wastewater contamination.

4. When PVC or ACP water lines twelve (12) inches and smaller are exposed during construction and the bedding is disturbed, the water line shall be changed out to ductile iron pipe (minimum Class 150) with mechanical joints or flanged joints.

5. Where conditions prevent adequate horizontal and vertical separation, both the water line and sewer line should be

constructed of ductile iron pipe (minimum Class 150) with mechanical joints or flanged joints.

6. Separation of water and electrical or gas lines shall conform to City of Goodyear Detail G-3300.

M. Culvert Crossings

1. The minimum clearance under culverts and storm drains shall be two (2) feet.

2. Valves shall be installed on both sides of each crossing in a manner which will minimize service disruption should the crossing need to be isolated for maintenance or repair. See Detail G-3301.

3. Lines shall not be deflected, or swept, but shall be installed in accordance with the City of Goodyear Detail G-3301.

4. Air valves shall also be installed at all culvert crossings as per Fittings Section in this manual.

N. Sampling Stations

1. The City of Goodyear requires sampling stations to be located in all new developments. The sampling stations are to be located within the right-of-way and constructed Detail G-3370. A sampling station will be required for every three hundred (300) dwelling units or less. A large development constructed in phases will be required to install the sampling point on the first phase and each subsequent phase when the dwelling units for all phases constructed exceed 300 units.

O. Fire Flow Requirements

1. Water distribution facilities shall be sized to deliver a minimum fire flow of:

   a. one thousand five hundred (1,500) gallons per minute (gpm) to commercial, industrial, and multi-family residential properties.

   b. one thousand (1,000) gallons per minute (gpm) to one and two-family dwelling unit residential properties.

   c. These fire flows are based on the requirements of the City of Goodyear Fire Code for approved automatic sprinkler systems.

2. Fire Hydrants

a. Materials and Details

(1) Fire hydrants shall conform to the City of Goodyear Specifications. Approved Fire Hydrant list is available at the Public Works Department.

(2) Fire hydrants shall be installed per Detail G-3330.

(3) The developer shall tap all energized mains after the developer places the tapping sleeve and valve. The installation must be approved by Field Engineering prior to tapping.

(4) The developer shall provide the fire hydrant, other necessary materials, and all labor for installation.

b. Spacing

(1) The spacing of fire hydrants is to be measured along the street or roadway in which a fire hose would be laid. Generally, this spacing is measured along the curb line.

(2) Fire hydrants shall be located outside of street improvements but within the right-of-way or easement. General spacing for fire hydrants shall be:

- 400 feet maximum in a single-family residential development.
- 300 feet maximum in a multi-family residential development.
- 350 feet maximum in a high rise, storage, or industrial complex.
- Fire hydrants shall not be installed on any portion of a dead-end line which is more than 400 feet from its source of supply (water line which is looped)

- Within 150 feet of the backflow prevention device with the fire department connection from the nearest hydrant.
- Fire hydrant spacing shall be maintained along required Fire Department access roads.
- Fire hydrant shall be a minimum distance of 40 feet from structures.
- 1,000 feet maximum for unloaded traffic corridors. (Roadways with no adjacent development).

c. Locations

(1) Fire hydrants at intersections shall be placed 2 feet back of the sidewalk and 4 feet from the curb return within the radius. Fire hydrants in mid-block shall be placed in line with side property extension, 2 feet back of the sidewalk. Care shall be taken to minimize conflicts with future driveways.

(2) Location of the fire hydrant shall be such that the pipe leading to the hydrant will be under the least amount of pavement.

(3) On private property, the fire hydrant shall be accessible along a Fire Department access road.

(4) A 3 foot minimum clearance shall be maintained around the fire hydrant per Detail G-3331. The hydrant shall be set 2 feet behind back of curb to the face of the fire hydrant.

(5) A finished grade elevation shall be shown for the "break-away" flange (traffic model type) on each fire hydrant. The minimum allowable distance between the centerline of the lowest hose outlet shall not be less than 18 inches above grade. See Detail G-3330.

d. Retro-Reflective Pavement Marker Requirements
Blue retro-reflective pavement markers shall be used as a method of identifying fire hydrant locations. Retro-reflective pavement markers shall be 911A-blue, Fire Lite, Amerace Corporation, Signal Products Division or equal.

Blue marker installations shall conform to the following required marker installation locations:

(1) Two-Way Streets or Roads - Markers should be placed 6 inches from edge of painted centerline on the side nearest the fire hydrant. If the street has no centerline, the marker should be placed 6 inches from the approximate center of the roadway on the side nearest the hydrant.

(2) Streets with Left Turn Lane at Intersection - Markers should be placed 6 inches from edge of painted white channelizing line on the side nearest the hydrant.

(3) Streets with Continuous Two-Way Turn Lane - Markers should be placed 6 inches from the edge of the painted yellow barrier line on the side nearest the fire hydrant.

(4) Street with Raised Medians - Marker should be placed 6-inches from lip of gutter on the side nearest the fire hydrant, and on the top of median curb on the side opposite the fire hydrant.

(5) Freeways and Expressways - Because of higher maintenance at these locations if placed on the roadway, markers should be placed on shoulder 1 foot to the right of the painted edgeline opposite the off-right-of-way fire hydrant location.

(6) Private drives in apartments, condos, etc., are same as item (1) above.

3. Fire Lines

a. Location of on-site fire lines and taps should be determined by the site relationship of the fire

department connection, riser location, emergency access, and fire hydrant locations. Size of fire lines shall be determined by City design criteria and flow test data provided by the engineer for the design of the project. Fire systems must include a back flow prevention device.

b. Plans shall be based on a flow test as per Fire Flow Requirements section of this manual. The drawings shall be of uniform size (24-inch by 36-inch) and shall be drawn to scale. One set of the approved civil water plans shall accompany this submittal. Applicable City of Goodyear and N.F.P.A. 24 construction notes shall also be included on the working drawings.

c. Installation will be per approved working plans. Any deviation from approved plans will require written permission of the authority having jurisdiction.

d. Inspections will be per N.F.P.A. 24 and as may be required by the Goodyear Fire Department and the Public Works Department.

P. Auxiliary Storage Tanks

1. Pressures and discharge flows required by Goodyear Fire Department will be for a minimum of two (2) hours for commercial projects, and may require a fire pump package installation when the building's construction type, occupancy fire load commodities' classification, volumetric building areas, building height and individual square footage areas per floor level produce a pressurized fire flow demand in excess of the water transmission main's capabilities.

2. For residential storage requirements see City ordinance requirements.

5.1.3 Zone Split

A. General

1. The City's water distribution system may be divided upon City approval into various zones. Each zone operates as an independent water distribution system, and cross connections between zones are prohibited.

B. Valving

1. At selected locations between the zones special valves have been installed. Operation of these valves shall be by City personnel only.

    a. Special Requirements for Developments Bordering Zone Splits

2. In those situations wherein a proposed development borders on the zone split boundary, the developer shall install a redundant main on the development side of the zone split boundary in order to insure that the subject development has a closed loop distribution system.

3. A redundant parallel main shall be required to close the loop within the development and shall be extended as necessary to connect to other distribution mains within the zone.

C. All plans for water distribution mains adjacent to these zone split boundaries shall be reviewed and approved by the City.

5.1.4 Booster Pump Station Design Standards

A. Pumps shall be vertical turbine type with all motors equipped with a solid shaft. Pumps shall be fitted with a mechanical seal and discharge piping from each pump must have a flexible coupling to control vibration.

B. All check valves shall be silent closing type.

C. Mercoid type pressure switches shall be used where applicable.

D. All control sensors shall be isolated from the system with shut-offs.

E. Three-phase 480 volt power shall be used where available.

F. Field prints shall include all electrical information.

G. Phase protection shall be provided for all three-phase motors and pumps.

H. Pump failure indicator lights shall be included on the control panel.

I. All pump station control panels shall be designed for the future installation of a telemetry system.

J. An hour meter shall be provided for each pump.

K. Air conditioning shall be provided for all VFD control panels

L. Pumping stations shall be equipped with water meters which register and totalize in US gallons.

M. Pump control, pressure relief, pressure reducing, and/or pressure sustaining valves shall have position indicators.

N. A properly designed air relief valve shall be mounted on top of all hydro-pneumatic tanks. Air relief valves shall be a minimum of two (2) inches. Hydro-pneumatic tanks shall be fitted with an isolation valve.

O. Area lights are to be wall-mounted with at least one operated by an electric eye.

P. All pump station sites shall be secured by a six (6) foot block wall with a minimum of two (2) access points. Access shall be provided by two gates - one shall be three (3) feet wide for walk through access; the other shall be twelve (12) feet wide for vehicular access.

Q. Underground pump stations shall include the following:

1. All underground pump stations shall be air conditioned. The air conditioning system shall be an air-cooled split system with the evaporator installed in the pump vault and the condenser located separately above ground. Careful consideration shall be given to proper air circulation and maintenance operations.

2. The vault shall be equipped with an automatic drainage system. Drainage system controls shall be located outside of vault and secured.

3. Vault shall have and alarm light and audible signal system to signal flooding of vault.

4. Human access doors shall be 2'-6" x 2'-6". Equipment access doors shall be 3'-0" x 3'-0". Access doors shall be equipped with torsion assisted hinges capable of providing the equivalent of a twenty (20) pound lift.

R. A minimum of three (3) sets of operations and maintenance manuals shall be prepared and provided to the Water Operations Division prior to the final inspection.

S. NOTE: It is recommended that designers coordinate their pump station design with the Water Operations Division and the City Engineer prior to final plan preparation (see Section 5.1.1.F.3 of this manual).

5.1.5 Plan Preparation

A. Plans shall be prepared per the guidelines in Construction Plans Preparation - Chapter 2.

Average Day Water Demand Per Dwelling Unit in GPD[†]

Land Use	Inside Use	Outside Use	Total Use
Residential <2 DU per acre	208.90	276.70	485.60
Residential 2 - 3.99 DU per acre	193.70	276.70	470.50
Residential 3 - 7.00 DU per acre	175.90	72.30	248.20
Residential 8 - 11.0 DU per acre	155.30	72.30	227.60
Residential 12 - 22 DU per acre	155.30	72.30	227.60
Resort Hotel (per room)	401.70	44.60	446.40
Resort Hotel Low Intensity (per room)	401.70	35.70	437.40
Commercial (per square foot)	0.75	0.11	0.90[††]
Cultural/Institutional (per acre)	669.50	669.50	1339.10
Office (per square foot)	0.50	0.075	0.60[††]
Industrial (per acre)	873.10	154.40	1027.50
Utility (per acre)	0.00	1785.40	1785.40
Open Natural (per acre)	0.00	0.00	0.00
Open Developed (per acre)	0.00	1785.40	1785.40
Open Golf (per acre)	0.00	4285.00	4285.00

[†]City of Scottsdale Water Supply - Distribution Mast Plan, June 1987, Prepared by NBS/Lowry Engineers & Planners.

[††]City of Phoenix Memorandum Water Demand and Wastewater Flow Generation Rates, April 1985.

TABLE 5-1
Average Day Water Demand Per Dwelling Unit in GPD